

GUIDE FOR CONSTRUCTION OF GROUND-SUPPORTED CONCRETE SLABS USING:



Replacing Traditional Steel Mesh



Factory Floor Slab, Bristol. England.



Recycling Center at Debarrena - San Sebastian, Spain



Valencia Train Station, Spain

IMPORTANT INFORMATION!

All data included in this guide relates exclusively to the use of Fibratec V12-AM Alkali-Resistant Glass Fibre. This fibre complies with BS EN 15422 : 2008 : Precast Concrete Products – Specification of Glass Fibres for Reinforcement of Mortars & Concretes and has the highest Zirconia content of all ARG Fibres. This provides resistance to alkalis present in the concrete mix.

All recommendations within this guide are from extensive testing and evaluation by the Structures Department of University of Almunia de Doña Godina (EUPLA) in Zaragoza, Spain.



IMPRINTED OR POLISHED PEDESTRIAN FLOORS (Pavements, Recreation Areas etc)

We recommend a dosage of between 1-2 kg of FIBRATEC V12-AM per cubic metre of concrete.



- ☒ Fibratec fibres reduce cracking and provide reinforcement.
- ☒ Fibratec fibres distribute 100% evenly throughout the slab.
- ☒ Fibratec fibres are invisible at the surface.
- ☒ Fibratec fibres are ideal for imprinted or polished concrete finishes.
- ☒ Fibratec is compatible with all chemical additives and concrete admixtures.

INDUSTRIAL AND VEHICULAR FLOORS



The following procedure will assist with the slab design :



- STEP1:** Ascertain the bearing rate of the substrate. (Typically expressed as CBR (California Bearing Ratio) percentage (%) or “k” factor)
- STEP2:** Determine the application of the concrete slab : Eg Car park, truck park, industrial warehouse floor. Presence of racking, forklifts etc. This information is important to determine the contact area of loads on the concrete slab.
- STEP3:** Identify the concrete grade, Eg C25, C30 etc.
- STEP4:** Select the correct slab thickness with fibre concrete to allow for punching shear and flexural strength for the given loads.

By following these four steps and our recommendations, most ground-supported concrete slabs may be constructed using Fibratec V12-AM . This removes the requirement for costly labour involved in transporting, cutting and placing of traditional crack-control, steel mesh.

STEP 1

IDENTIFY THE BEARING RATE OF THE SUBSTRATE (% CBR)

ASTM SOIL CLASSIFICATION			DESIGNATION	DESCRIPTION	EXPECTED CBR			
					NOT COMPACTED	COMPACTED		
Coarse grained soils more than 50% retained on or above No.200 (0.075 mm) sieve	Gravel > 50% of coarse fraction retained on No. 4 (4.75 mm) sieve	Clean gravel <5% smaller than #200 Sieve	GW	Well-graded gravel, fine to coarse gravel		OVER 38%		
			GP	Poorly graded gravel		OVER 38%		
		Gravel with >12% fines	GM	Silty gravel		OVER 20%		
			GC	Clay gravel		OVER 20%		
	Sand ≥ 50% of coarse fraction passes No.4 sieve	Clean sand	SW	Well-graded sand, fine to coarse sand		OVER 20%		
			SP	Poorly graded sand		OVER 20%		
		Sand with >12% fines	SM	Silty sand		OVER 20%		
			SC	Clay sand		15%		
			Fine grained soils 50% or more passing the No.200 sieve	Silt and clay liquid limit < 50	ML	Inorganic silt	5%	10-15%
					CL	Inorganic clay of low plasticity, lean clay	5%	10-15%
OL	Organic silt, organic clay	4%			6%			
Silt and clay liquid limit ≥ 50	MH	Inorganic silt of high plasticity, elastic silt		4%	6%			
	CH	Inorganic clay of high plasticity, fat clay		3%	4%			
	OH	Organic clay, organic silt		3%	4%			
	PT	Peat		0	0			

Converting bearing rate or “k” value of the ground to CBR :

Ev ₂ MN/m ²	“k” value			Bearing Rate
	Mpa	kPa/mm	T/m ³	
30	25	0,025	2.500	3,0%
60	50	0,05	5.000	8,0%
120	100	0,1	10.000	38,0%

} CBR

In the absence of ground conditions, we advise that the substrate should be compacted as much as possible. Assume a 3% CBR value in order to provide a sufficient safety margin.

STEP 1 COMPLETED: “CBR” OF THE SUBSTRATE ESTABLISHED

STEP 2

DEFINE THE APPLICATION OF THE SLAB IN ORDER TO IDENTIFY THE AREA OF CONTACT BETWEEN LOADS AND THE CONCRETE SLAB

TYPE OF CONSTRUCTION	TYPE OF APPLICATION	Defined contact area (cm)
INDUSTRIAL AREA	Storage racks/small forklift	11X11
	Truck / trailer	40X40
	Small or big forklift	15X15
PARKING/TRANSIT AREA OR ACCESS FOR:	Cars	15X15
	Vans	20X20
	Trucks, trailers	40X40

CONTACT AREA

In the absence of reliable information regarding the intended use of the concrete slab, or to allow for future change of use, we recommend the use of the smallest defined contact area (11cm x 11cm) in order to provide a safety margin.

STEP 2 COMPLETED: THE CONTACT AREA WITH THE SLAB IS DEFINED

STEP 3

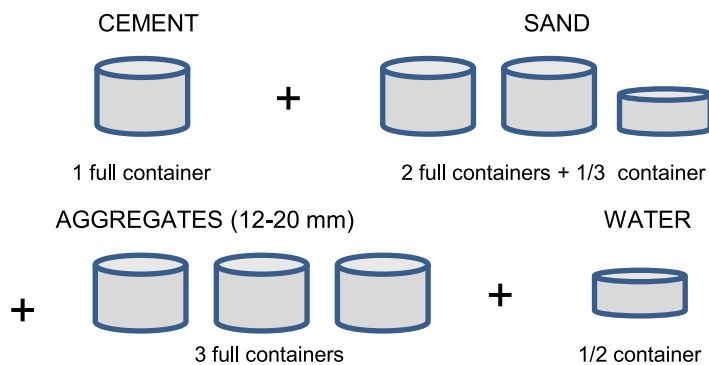
DEFINE THE CONCRETE GRADE FOR THE CONCRETE SLAB.
TYPICAL GRADES OF CONCRETE FOR FLOOR SLABS ARE C25 OR C30.

For site mixed concrete, using a small mixer, we suggest the following procedure for proportioning materials an approximate grade of C25 (Note : when using volumetric proportions the compressive strength should always be confirmed by testing/proportions modified to suit available materials) Using this guide, Point Load Values from the C25 column would be used in STEP 4.

BY WEIGHT (For 100 lt of concrete)

CEMENT:	28 kg
SAND:	70 kg
AGGREGATES (12-20mm)	125 kg
WATER:	16 kg

BY VOLUME (Using the same size container)



STEP 3 COMPLETED: CONCRETE GRADE

STEP 4

CALCULATING THE THICKNESS OF THE SLAB , BASED ON THE FLEXURAL AND PUNCHING STRENGTH OF A GIVEN GRADE OF FIBRE-ENTRAINED CONCRETE.

SECURITY FACTOR S: $\gamma_G=1,35$ (own weight), $\gamma_Q=1,50$ (overload) and $\gamma_c=1,50$ (concrete)

SUPPORTED POINT LOADS WITH USE OF 3 KG OF FIBRATEC V12-AM / M³ OF CONCRETE

AREA OF CONTACT WITH SLAB: 11CM X 11CM (footprint of point load)

Typical application : Small forklifts with small wheels, storage racks in warehouse...



SLAB THICKNESS (cm)	CBR 3% - 8% - 38%		Distance between expansion joints INDOOR SLABS	Distance between expansion joints OUTDOOR SLABS	Depth of cut joint (cm)
	C25 * kg point load	C30 * kg point load			
12	2100	2200	3m – 3.5m	2m - 3m	4
13	2400	2550	3m – 3.5m	2m - 3m	4
14	2700	2900	3.5m - 4m	2.5m – 3.5m	4.5
15	3000	3200	3.75m – 4.5m	3.5m - 4m	5
16	3400	3600	3.75m – 4.5m	3.5m - 4m	5
17	3800	4000	4m - 5m	3.5m - 4m	5.5
18	4100	4350	4m - 5m	3.5m - 4m	6
19	4500	4750	4.25m – 5.50m	4m - 5m	6
20	4900	5200	4.25m – 5.50m	4m - 5m	6.5
21	5300	5700	4.5m - 6m	4m - 5m	7
22	5750	6200	4.5m - 6m	4.5m - 6m	7
23	6350	6700	4.75m – 6.5m	4.5m - 6m	7.5
24	6750	7150	4.75m – 6.5m	4.5m - 6m	8

Length of cut joint should not be greater than = width x 1,5. Square cuts are advisable
For 2 kg dose of V12-AM Fibrattec /m³, simply decrease point loads given in above table by approximately 10%

SUPPORTED POINT LOADS WITH USE OF 3 KG OF FIBRATEC V12-AM / M³ OF CONCRETE

AREA OF CONTACT WITH SLAB: 15CM X 15CM (footprint of point load)

Typical application : Car park, large-wheeled forklift...



SLAB THICKNESS (cm)	CBR 3% - 8% - 38%		Distance between expansion joints INDOOR SLABS	Distance between expansion joints OUTDOOR SLABS	Depth of cut joint (cm)
	C25 * kg point load	C30 * kg point load			
12	2380	2500	3m – 3.5m	2m - 3m	4
13	2800	2900	3m – 3.5m	2m - 3m	4
14	3000	3200	3.5m - 4m	2.5m – 3.5m	4.5
15	3400	3580	3.75m – 4.5m	3.5m - 4m	5
16	3700	4000	3.75m – 4.5m	3.5m - 4m	5
17	4100	4400	4m - 5m	3.5m - 4m	5.5
18	4500	4800	4m - 5m	3.5m - 4m	6
19	4900	5200	4.25m – 5.50m	4m - 5m	6
20	5300	5650	4.25m – 5.50m	4m - 5m	6.5
21	5800	6100	4.5m - 6m	4m - 5m	7
22	6200	6600	4.5m - 6m	4.5m - 6m	7
23	6700	7100	4.75m – 6.5m	4.5m - 6m	7.5
24	7200	7700	4.75m – 6.5m	4.5m - 6m	8

Length of cut joint should not be bigger than = width x 1,5. Square cuts are ideal
* For 2 kg dose of V12-AM Fibrattec /m³, simply decrease point loads given in above table about 10%

Note that for small load contact areas equal or smaller than 20 x 20 cm, flexural strength is not as important as punching (puntural) strength of concrete,. Therefore, bearing rate CBR does not influence the load supported by the slab.

SUPPORTED POINT LOADS WITH USE OF 3 KG OF FIBRATEC V12-AM / M³ OF CONCRETE
AREA OF CONTACT WITH SLAB: 20CM X 20CM (footprint of point load)
 Typical application : Car Parking, small trucks, larger forklifts



SLAB THICKNESS (cm)	CBR 3% - 8% - 38%		Distance between expansion cut joints INDOOR SLABS	Distance between expansion cut joints OUTDOOR SLABS	Depth of cut joint (cm)
	C 25 * kg point load	C 30 * kg point load			
12	2600	2850	3m – 3.5m	2m - 3m	4
13	3000	3200	3m – 3.5m	2m - 3m	4
14	3400	3600	3.5m - 4m	2.5m – 3.5m	4.5
15	3800	4000	3.75m – 4.5m	3.5m - 4m	5
16	4100	4400	3.75m – 4.5m	3.5m - 4m	5
17	4500	4800	4m - 5m	3.5m - 4m	5.5
18	4950	5200	4m - 5m	3.5m - 4m	6
19	5400	5800	4.25m – 5.50m	4m - 5m	6
20	5800	6180	4.25m – 5.50m	4m - 5m	6.5
21	6300	6700	4.5m - 6m	4m - 5m	7
22	6800	7250	4.5m - 6m	4.5m - 6m	7
23	7350	7800	4.75m – 6.5m	4.5m - 6m	7.5
24	7850	8250	4.75m – 6.5m	4.5m - 6m	8

Length of cut joint should not be greater than = width x 1.5. Square cuts are advisable
 For 2 kg dosage of V12-AM Fibrattec /m³, simply decrease point loads given in the above table by approximately 10%

NOTE: In small areas of contact up to 20 x 20 cm, flexural strength has less influence than punching shear resistance of concrete indetermining the limit loads. For this reason, the CBR is not the primari influence.

SUPPORTED POINT LOADS WITH USE OF 3 KG OF FIBRATEC V12-AM / M³ OF CONCRETE
AREA OF CONTACT WITH SLAB: 40CM X 40CM (footprint of point load)
 Typical application : : Truck parking, truck or trailer with multiple axles, transit areas...



SLAB THICKNESS (cm)	CBR 3%		SLAB THICKNESS (cm)	CBR 8%		SLAB THICKNESS (cm)	CBR 38%	
	C 25 *kg point load	C 30 *kg point load		C 25 *kg point load	C 30 *kg point load		C 25 *kg point load	C 30 *kg point load
12	3500	3600	12	4000	4100	12	4020	4150
13	3900	4000	13	4350	4400	13	4450	4500
14	4150	4250	14	4700	4800	14	4850	4900
15	4600	4750	15	4900	5000	15	5100	5200
16	4950	5050	16	5300	5400	16	5600	5700
17	5200	5400	17	5600	5800	17	6000	6200
18	5800	5900	18	6000	6100	18	6550	6800
19	6150	6300	19	6400	6650	19	7250	7500
20	6800	6900	20	7000	7400	20	7850	8340
21	7350	7550	21	7950	8400	21	8400	8950
22	8100	8400	22	8000	9400	22	9000	9500
23	9000	9300	23	9550	10100	23	9550	10100
24	9800	10100	24	10100	10800	24	10100	10800

Information regarding distances between cut joints for above table is exactly the same as indicated in the above tables. Please check slab thcikness in previous tables and apply same joint distances and depths when executing your project.

Length of cut joint should not be greater than = width x 1.5. Square cuts are advisable.
 For 2 kg dose of V12-AM Fibrattec /m³, simply decrease point loads given in the above table by approximately 10%